PB84-198654

Quality Assurance in Inspection/Maintenance Programs

(U.S.) Environmental Protection Agency
Ann Arbor, MI

Apr 84

U.S. Department of Commerce
National Technical Information Service
NTIS

PB84-198654

EPA-AA-IMG-84-2

Technical Report

Quality Assurance in Inspection/Maintenance Programs

By

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April 1984

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Technical Support Staff
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Office of Mobile Sources
Office of Air and Radiation
U.S. Environmental Protection Agency

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NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA 22161

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. EPA-AA-IMG-84-2	2.	3. Recipient's Accession No. PB84-198654

4. Title and Subtitle

Quality Assurance In Inspection/Maintenance Programs.

5. Report Date April 1984

6.

7. Author(s) John M. Cabaniss

8. Performing Organization Rept. No.

9. Performing Organization Name and Address

U.S. Environmental Protection Agency
Office of Mobile Sources
Technical Support Staff
Ann Arbor MI 48105

10. Project/Task/Work Unit No.

11. Contract(C) or Grant(G) No.

(C)

(G)

12. Sponsoring Organization Name and Address

13. Type of Report & Period Covered Technical

14.

15. Supplementary Notes

This report was presented to the Tenth North American Motor Vehicle Emission Control Conference held in New York, NY on April 2, 1984.

16. Abstract (Limit: 200 words)

This report discusses the various aspects of using quality assurance (QA) as a form of management control. The use of QA when undertaken by the states can determine if Inspection and Maintenance (I/M) programs are operating as intended and whether overall program objectives are being achieved.

17. Document Analysis a. Descriptors

Air Quality
Inspection
Maintenance
Motor Vehicles
Management Systems
Objectives
Quality Control

b. Identifiers/Open-Ended Terms

States
Inspection/Maintenance

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
Release Unlimited	unclassified	13
	20. Security Class (This Page) unclassified	22. Price

(See ANSI-Z39.18) *See Instructions on Reverse*

OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

Quality Assurance in Inspection/Maintenance Programs*

Introduction

The term "quality assurance" is often defined and interpreted in many ways. Therefore, it is appropriate to begin this discussion of quality assurance in inspection/maintenance (I/M) programs with a description of how the term is being used here. In this report, quality assurance (QA) refers to the formal system of activities undertaken by the State or locality to determine whether the program is operating as intended and whether overall program objectives are being achieved. In this context, QA involves a continuous pattern of information feedback to the I/M program managers in order to allow those midcourse corrections or modifications that may be needed to keep the program on track toward meeting the desired objectives. QA efforts as discussed here provide I/M managers one way to effectively manage their programs.

A good synonym for QA might be "program analysis", if part of the "analysis" includes a determination and implementation of any needed corrective actions. Also, it is important to recognize that QA is a continuous, cyclic process of management control and that the focus of QA is on problem-solving.

The Quality Assurance Process

The QA process is basically a simple management system. The first step is to set expectations (goals and objectives) for each major element of design of the I/M program (i.e., for test procedures, emissions standards, record keeping, analyzer quality control, enforcement, waivers, mechanic training, repair costs, etc.).

For example, the goals for emissions standards might include:

1. To achieve significant emissions reductions while not overburdening repair facilities or jeopardizing public acceptance.

2. To provide for similar or equitable failure rates across vehicle design or age categories.

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*This report was presented to the Tenth North American Motor Vehicle Emission Control Conference sponsored by the State and Territorial Air Pollution Program Administrators and EPA in New York, New York on April 2, 1984.

3. To provide compatibility with the federal 207(b) emissions warranty requirements for 1981 and newer model year vehicles.

These goals might be translated into the following objectives:

1. For pre-1981 vehicles, to achieve an overall failure rate of 20 percent with no individual model year's failure rate being below 10 percent or above 30 percent.

2. For 1981+ vehicles, to use the 207(b) warranty cutpoints in order to maximize both the identification of gross emitters and the utility of the warranty (the expected failure rate for these vehicles would be 3-7 percent using an idle test).

These objectives would then be used to guide the State's choice of emissions standards for each class of vehicles being inspected.

The second step in the QA process is to establish a way to determine whether the objectives are being met. This involves collecting and analyzing data. In the simple example above, inspection data would be analyzed to determine the actual failure rate being experienced by model year and overall to see if the objectives are being achieved.

The third step in the QA process is to investigate any apparent problem areas to determine the cause of each problem and the corrective action needed to resolve it. This is by far the hardest step in the process because many problems are often related to several different aspects of a program. Therefore, it is often difficult to pinpoint the exact problem and solution. In some cases, the real solution may be a combination of corrective measures. Because of these complications, when a problem is identified, it is important to carefully investigate it before trying to reach conclusions about its cause and solution. The investigation of problem areas usually involves an in-depth analysis of existing data and often involves collecting new data or conducting special studies.

Continuing the previous example, if it were determined that the failure rate among pre-1981 vehicles was 5 percent instead of the 20 percent objective, the problem would not necessarily be that the cutpoints were too lenient, as one might think initially. Other factors, such as inadequate analyzer leak checks, could cause the low failure rate, or it could be that the data itself is not accurate. These

situations have to be investigated in order to determine the real cause of the problem. If instead the cutpoints were tightened, there may not necessarily be a corresponding increase in the failure rate because the real problem was not resolved.

The fourth and final step in the QA process is to implement the corrective actions and then begin the QA cycle again to make sure that the problem is resolved.

Current QA Issues in I/M Programs

Recent EPA evaluations have identified three primary problem areas in the operating I/M programs:

1. High levels of non-compliance (in excess of 20 percent) among vehicle owners in some regionalized programs with sticker enforcement systems.

2. Low reported failure rates (less than half of design) in some decentralized programs.

3. Seemingly excessive waiver rates in some programs (waiver rates greater than 10 percent of failed vehicles).

High Non-Compliance:

EPA has always maintained that the most effective I/M enforcement system is provided by denying vehicle registration to noncomplying vehicles. However, States have been allowed to use alternate enforcement methods, as long as they were as effective as a registration denial system. Because of their popularity in safety inspection programs, many States have opted to use sticker enforcement systems in their I/M programs. In regionalized I/M programs, however, sticker systems have not worked well because of several factors:

1. In regionalized I/M programs, there are many unstickered, excluded vehicles on local streets. Therefore, it is difficult for police to determine whether an unstickered vehicle is actually a violator.

2. Stickers themselves are sometimes not designed such that violators can be easily determined.

3. Stickers are usually on the windshield, whereas the license plate (which may identify county or month of inspection) is usually on the rear of vehicle, thus confounding the comparison of the two in order to judge compliance.

4. Police are often prohibited from citing parked vehicles; therefore, the only vehicles closely examined for compliance are those stopped for other reasons.

5. Police often do not give as much priority to enforcement of inspection stickers as they could.

One State which has experienced this problem is Colorado. Upon investigation Colorado decided that their problem was primarily due to the lack of an incentive for local police to enforce the program (since all I/M fines went to the State treasury) and to the fact that only moving violators could be cited. Therefore, last year the State I/M law was amended to allow localities to adopt their own ordinances which would allow I/M fines to go to the local treasury rather than the State treasury. Also, another amendment was adopted to allow parked vehicles to be cited. The response to these changes, which took effect in January, has been dramatic. In January alone, the City of Denver collected over $100,000 in I/M fines. State officials report that the compliance rate has definitely improved, despite the fact that all localities have not yet adopted local ordinances.

Of course, EPA feels that the ultimate solution to a sticker enforcement problem would be to enforce the I/M program through vehicle registration. But, as pointed out in the Colorado case, other solutions are possible.

Low Reported Failure Rates:

Some decentralized I/M programs are experiencing low reported failure rates. In evaluating I/M programs, EPA has found that the reported failure rates in decentralized I/M programs are often less than in comparable centralized programs. Part of this phenomenon may be explained by pre-inspection repairs or tune-ups. Another explanation may be that inspection personnel take shortcuts in recording inspection data and do not always report initial emissions failures which they repair and retest immediately. EPA believes that each of these arguments is valid to an extent, but that these factors should not dramatically lower the reported failure rates.

Other more serious situations which could also result in low reported failure rates would be:

1. Cheating or incompetence among inspectors resulting in broadscale improper record keeping, improper testing, etc.

2. Inadequate analyzer quality control resulting in excessive leaks and, thus, low readings and fewer failures.

Some possible solutions to this kind of problem would include:

1. Retraining of inspectors on the importance of proper data collection and other procedures.

2. Tighter surveillance on analyzers and data.

3. Improved inspection form or reporting mechanisms (e.g., this could include changing from a manual data system to automatic data collection).

4. Tighter I/M cutpoints.

While the latter (tighter cutpoints) is a possible solution, especially in programs that have been operating for a few years, EPA believes that most current I/M programs have adopted reasonable I/M cutpoints, except that a number of the programs are using less stringent standards than the 207(b) cutpoints for 1981 and newer vehicles. EPA believes that there is ample data available from both EPA and State testing to show that the 207(b) cutpoints are effective in identifying gross emitters and do not yield excessive failure rates. Current testing has shown that less than 10 percent of 1981 and newer vehicles usually fail an idle mode short test using these cutpoints. In addition, of course, most 1981 and newer vehicles failing an I/M test are eligible for warranty protection. Therefore, EPA feels that all State and local I/M programs should use the 207(b) cutpoints for 1981 and newer vehicles.

Excessive Waiver Rates:

Some States are reporting seemingly high waiver rates. High waiver rates are a concern because, in general, lower emissions reductions are obtained from waived vehicles. High waiver rates are often symptomatic of other problems. For instance, high waiver rates can sometimes indicate a problem with the competence of mechanics and, thus, a need for more mechanic training. Poor analyzer quality control practices in repair garages can also cause waiver rates to be high because a mechanic, relying on an inaccurate analyzer, may inadequately repair the vehicle before it is submitted for retesting. There may also be problems, in some cases, with the procedures used in issuing waivers or in the criteria on which waivers are based. Sometimes, for instance, the waiver repair cost limit may be too low, or there may not be a provision to prevent tampered vehicles from receiving waivers.

In at least one State, there has been an apparent problem with high average repair costs which in turn has caused the waiver rate to be high. Such information provides further evidence of poor mechanic skills which lead to unnecessary repairs and higher costs.

Some possible solutions to correct a high waiver rate would include:

1. Stricter waiver criteria and procedures.

   a. Require tampering to be repaired before a vehicle is eligible for a waiver.

   b. Review receipts or work orders to verify that repairs are appropriate for the type of vehicle and the type of I/M failure.

   c. Disallow waivers for vehicles covered under warranty or prepaid maintenance agreements.

   d. Increase the repair cost ceiling or require specific minimum repairs in lieu of a repair cost ceiling.

2. Better mechanics training.

   a. Start or expand formal training.
   b. Create incentives for mechanic participation.
   c. Promote the benefits of the training.

3. Better quality control procedures for analyzers in repair facilities (especially in centralized programs where the repair facilities are generally under less scrutiny by the State).

4. Better surveillance of repair facilities including monitoring of waiver rates by facility.

5. Better consumer awareness about the kinds of repairs and their approximate costs for different types of I/M failures.

6. Better monitoring of repair costs by garage (perhaps publish a list of average costs by garage for public information).

Other Problem Areas:

In addition to the three primary problem areas noted above, EPA has also noted several lesser problems in evaluating the operating I/M programs. In some cases, minor problems have been noted with analyzer maintenance and quality control procedures, especially in the area of finding and repairing system leaks. There have also been some reported problems with data collection, both in manual and automatic data collection systems.

Importance of Data Collection

Data collection and analysis is the key element to the QA process. Its importance cannot be overstated. Without accurate data, it is impossible to ensure a properly operating program. Without accurate data, problems cannot be identified for resolution, and, just as important, successes cannot be verified.

The following data are important in the QA process:

1. Test data on vehicles.

2. Summaries by inspection station (or by lane in a centralized system).

   a. Failure rate.
   b. Waiver rate.

3. Repair data.

   a. Types of repair.
   b. Cost of repairs.

4. Surveillance data.

   a. Audit results.
   b. Results of undercover operations.
   c. Results of roadside or independent checks.
   d. Results of challenge tests or complaint investigations.

The methods of collecting these data vary considerably according to the type of program (centralized or decentralized), the type of analyzers (manual or computerized), and the type of data. Almost all centralized I/M programs use computers to automatically collect test data. However, there is more variety among decentralized programs in collecting test data. Some use computerized analyzers which have automatic data collection, a few use

machine-readable forms, but most collect test data manually. In the two former cases, the test data can easily be analyzed electronically. However, most States which collect test data manually rely on analyzing random samples of the test data by transferring the sample data to computer media. Random sampling is usually adequate for overall statistics, as long as the size of the sample is large enough to be representative.

Station by station statistics can be easily derived in those cases where the test data is collected by computer or on machine-readable forms. In the case of manual data collection, station summaries can be easily obtained through monthly (or other periodic) activity reports. In such cases, simple tally sheets can be used to report the number of vehicles inspected, passed, failed, and waived during the month (or other period). This type of report requires minimal time for station personnel to complete the report, but allows the program manager an easy and quick way to track failure rates and waiver rates by inspection station and overall.

Repair data should be included on the test form whenever possible. This is often done by having a checklist of repairs which can be checked off as performed. When such lists are used, it is important to periodically revise that part of the form to add new items or delete those that are never used. In many cases, the repair data sections on current I/M forms are incomplete or out-of-date because they do not include categories applicable to 1981 and newer vehicles.

Surveillance data should be collected through formal audit reports and other reports on surveillance activities. These reports must be reviewed manually, but the information they provide is essential for tracking station performance.

Summary

Regardless of the type of I/M program, QA is an essential function. QA provides the means for documenting program successes and for addressing the following questions:

1. Is the program operating as intended?

2. Is it meeting its objectives?

3. Are these special problems that need to be addressed?

4. What is the proper way to solve these problems?

5. Once implemented, did the solution really work?

Data collection and analysis is the key element of the QA process. Various methods are available to the I/M program manager to obtain and analyze the needed data.

As all program managers know, regardless of how good things are, they could always be better. The purpose of the QA process is to help managers identify ways to keep their programs functioning optimally.